

SPECIFICATION

Please amend the paragraph starting on line 24 on page 10 as follows:

However, when the passivation film of the element is formed from ferrite as disclosed in USP No. 5,902,690, because of a low magnetic saturation in the ferrite itself (for example, 0.2 to 0.5 tesla (T) in general ferrite materials), it is impossible completely to prevent penetration of external magnetic fields. Magnetic saturation in the ferrite itself is approximately 0.2 to 0.35 T in NiZn ferrite, and 0.35 to 0.47 T in MnZn ferrite, however, a magnitude of an external magnetic field penetrating into the MRAM element is as large as several hundreds Oe, thereby only with such a degree of saturation magnetization provided by the ferrite, a permeability becomes almost "1" due to magnetic saturation in the ferrite thereby disabling its function. Further, although a film thickness is not described in USP No. 5,902,690, because a thickness of a normal passivation film is about 0.1 μm or so at most, it is too thin to serve as a magnetic shield layer, thereby any substantial effect cannot be expected. Moreover, in the case if ferrite is to be used as the passivation film, because the ferrite is an oxide magnetic material, when it is deposited by sputtering, an oxygen defect tends to occur, thereby making it difficult to obtain a perfect ferrite to be used as the passivation film.

Please amend the paragraph starting on line 15 on page 11 as follows:

Further, in USP No. 5939772, a structure for sandwiching the package between the upper and the bottom Permalloy layers is disclosed. By use of the Permalloy, a higher shield performance than that of the ferrite passivation film is obtained. However, although the permeability of the Mu metal disclosed in USP No. 5939772 is very high to become $\mu_i=100,000$ or so, the magnetic saturation thereof is very low to be 0.7 to 0.8 T, at which it will easily saturate to an external magnetic field consequently to become $\mu=1$, therefore, there is a problem that in order to obtain a perfect magnetic shielding effect, a thickness of the shield layer must be increased considerably large. Therefore, as the structure for enabling to prevent penetration of magnetic fields of several hundreds Oe, in practice, it is not yet perfect as the magnetic shield layer in view of both drawbacks that the saturation magnetization thereof is too small and that the thickness thereof is too thin.

Please amend the paragraph starting on line 1 on page 12 as follows:

Still further, in Japanese Patent Application Publication No. 2001-250206, although a magnetic shield structure using soft iron or the like is disclosed, as this covers only the upper portion of the element, it is not perfect as the magnetic shield. Also, the magnetic characteristics thereof are not sufficient because that the saturation magnetization of the soft iron is 1.7T and the permeability thereof is $\mu_i=300$ or so. Therefore, even if a magnetic shield is fabricated using the structure disclosed in Japanese Patent Application Publication JP-A Laid-Open No. 2001-250206, it would be very difficult to completely prevent the penetration of external magnetic fields.

Please amend the paragraph starting on line 26 on page 14 as follows:

FIG. 7 is a distribution diagram of internal magnetic field strengths in the case where a high permeability material of Fe-49Co-2V was used, and a thickness of a magnetic shield layer (shield foil) was at 200 μm , and when an external magnetic field of 500 Oe was applied, according to the embodiment of the present invention.

Please amend the paragraph starting on line 16 on page 18 as follows:

~~In these examples, MRAM elements (each being a chip including a memory cell portion and a peripheral circuitry portion) 30 as shown in FIGS. 14 to 16 are mounted on a die pad 40 avoiding the edge portion.~~ In the examples, MRAM elements 30 (each being a chip including a memory cell portion and a peripheral circuitry portion as shown in FIGS. 14 to 16) are mounted on a die pad 40 avoiding the edge portion and the central portion of the magnetic shield layers 33 and 34, then, all portions except for an external lead 31 (the die pad and the lead section inclusive of their wiring are simply drawn) to be connected to a package substrate (not shown) are sealed with a sealing material 32 such as mold resin (e.g. epoxy resin). Here, the description of the MRAM element 30 is omitted because of its similar structure and operation principle to those of the MRAM described already.

Please amend the paragraph starting on line 23 on page 22 as follows:

An internal magnetic field strength distribution is shown in FIG. 6 for the case where, as a typical material among various shield materials, a super Permalloy: Fe-75Ni-5Mo-1Cu which is the highest permeability material was used as the magnetic shield layer material in the experiments. The Fe-75Ni-5Mo-1Cu has an initial permeability $\mu_{r,i}=100000$, and saturation magnetization $M_s=0.8$ T. The internal magnetic field strengths are shown as a distribution over a length of the shield layer, that is, a length of 28 mm from one end to the other end. The external magnetic field to be applied was set at 500 Oe, and a thickness of the shield layer at $200\mu\text{m}$.

Please amend the paragraph starting on line 13 of page 24 as follows:

From the result indicated in FIG. 8, in order to ensure for the MRAM to operate normally, it is preferable to suppress the internal magnetic field strength as much as possible. Then, if an upper limit of the internal magnetic field strength is set at 20 Oe, it is considered consequently that a high saturation magnetization material such as Fe-49Co-2V or the like is to be used as a magnetic shield layer material and a thickness of the shield layer is to be set $400\mu\text{m}$ or more. However, in the age in demand of more compact and light-weighted electronics devices, it is anticipated to become more difficult to mount two sheets of such a shield layer of $400\mu\text{m}$ thick on the top and bottom within an electronic device. Nevertheless, if a stricter upper limit to the internal magnetic field strength is set, it becomes necessary for the thickness of the shield layers to be increased further.

Please amend the paragraph starting on line 3 on page 25 as follows:

FIG. 9 shows a result of measurements of internal magnetic field strength distributions per various thicknesses of Fe-49Co-2V used as the material. The internal magnetic field strength shows a distribution relative to a length of the shield layer, that is, within L: 28mm of FIG. 5. A gap between the shield layers was assumed constant (at 3.45mm), an external magnetic field to be applied was assumed 500 Oe, and the thickness of the shield layer was varied 250, 270, 300, 320, 350, 400 and $600\mu\text{m}$.

Please amend the paragraph starting on line 12 on page 25 as follows:

As a result, as shown in FIG. 9, it is known that although a penetrating magnetic field strength became larger in the center portion and the edge portion of the package, a shield effect is exhibited in other portions outside the above, and that even with a thickness of $350\mu\text{m}$ of the shield layer, a same shield effect as with a thickness of $600\mu\text{m}$ thereof was exhibited except for the edge portion and the center portion of the package.

Please amend the paragraph starting on line 6 on page 26 as follows:

A package of 160 pin QFP type has approximately a size of $28\text{mm} \times 28\text{mm}$, of which an area available for MRAM is several square mm or 10 square mm at most. In consideration of this and the aforementioned result, MRAM elements 30 are disposed in a part of the intermediate region 41 avoiding the edge region 43 and the center region 42 of the magnetic shield layer within the package (refer to FIG. 13B). Thereby, even with a thickness of the shield layer set at $350\mu\text{m}$, the MRAM was confirmed to have been shielded from the external leakage magnetic field and to have operated normally.

Please amend the paragraph starting on line 16 on page 26 as follows:

In the next, using Fe-49Co-2V as the material of the magnetic shield layer in the experimental equipment shown in FIG. 5, with the gap between the shield layers set at 2mm , the thickness of the shield layer at $200\mu\text{m}$, with an external magnetic field to be applied set constant at 500 Oe , then by changing the length of the shield layers variously, magnetic field strengths in the center portion of the sandwich structure were measured, the result of which is shown in FIG. 10, and distributions of the internal magnetic field strengths per length of the shield layer are shown in FIG. 11.